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FORM PTO-1390 (REV. 12-2001) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: 40038.001

U.S. APPLICATION NO. (If known, see 37 CFR 1.5): 10/089125

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/KR00/00792	July 24, 2000	

TITLE OF INVENTION
Method of Reducing a Band Mark of an Electroplating Steel Sheet

APPLICANT(S) FOR DO/EO/US
Kim, Hyung-Jun et al.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [X] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. [ ] This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. [ ] The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. [X] A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [X] is attached hereto (required only if not communicated by the International Bureau).
   b. [ ] has been communicated by the International Bureau.
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US).
6. [X] An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. [X] is attached hereto.
   b. [ ] has been previously submitted under 35 U.S.C. 154(d)(4).
7. [ ] Amendments to the claims of the International Aplication under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [ ] are attached hereto (required only if not communicated by the International Bureau).
   b. [ ] have been communicated by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [ ] have not been made and will not be made.
8. [ ] An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. [ ] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. [ ] An English lanugage translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. [ ] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. [ ] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [X] A FIRST preliminary amendment.
14. [ ] A SECOND or SUBSEQUENT preliminary amendment.
15. [ ] A substitute specification.
16. [ ] A change of power of attorney and/or address letter.
17. [ ] A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. [ ] A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. [ ] A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. [ ] Other items or information:

JC13 Rec'd PCT/PTO 22 MAR 2002

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
10/089125	PCT/KR00/00792	40038.001

21. ☒ The following fees are submitted:	CALCULATIONS PTO USE ONLY	
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):		
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO **$1040.00**		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO **$890.00**		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO **$740.00**		
International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) **$710.00**		
International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) **$100.00**		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 1040.00	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$	

CLAIMS	NUMBER FILED		NUMBER EXTRA	RATE		
Total claims	22	- 20 =	2	x **$18.00**	$ 36.00	
Independent claims	4	- 3 =	1	x **$84.00**	$ 84.00	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)				+ **$280.00**	$	
TOTAL OF ABOVE CALCULATIONS =					$ 36.00	
☐ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.				+	$	
SUBTOTAL =					$ 1160.00	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)).					$	
TOTAL NATIONAL FEE =					$ 1160.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +					$	
TOTAL FEES ENCLOSED =					$ 1160.00	
					Amount to be refunded:	$
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a. ☐ A check in the amount of $ _____ to cover the above fees is enclosed.

b. ☒ Please charge my Deposit Account No. 18-0013 in the amount of $ 1160.00 to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 18-0013. A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

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NAME

39,481
REGISTRATION NUMBER

10/089125

Attorney Docket No. 40038.001

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application: Hyung-Jun KIM et al. Serial No.: Unassigned Filed: Herewith For: METHOD OF REDUCING A BAND MARK OF AN ELECTROPLATING STEEL SHEET	Group Art Unit: Unassigned Examiner: Unassigned

Commissioner for Patents
Washington, D.C. 20231

Box Non-Final Response

Sir:

PRELIMINARY AMENDMENT

Prior to a first Office Action on the merits, Applicants respectfully request entry of the following amendments.

IN THE CLAIMS

Please cancel claims 1-8 and substitute the following claims therefore.

---9. A conductor roll for electroplating steel sheets, comprising:

a central portion with a metal-containing surface;

intermediate portions with a ceramic surface; and

end portions with a rubber surface.

I hereby certify that this correspondence is being deposited with the United States Postal Service in an Express Mail Label envelope, label number EU221555496US, addressed to:
Assistant Commissioner for Patents, Washington, D. C. 20231, on this 22nd Day of March, 2002.

Signed: Emily L. Foley

Dated: 3/22/02

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3/22/2002

10. The conductor roll of claim 9, wherein the ceramic surface comprises ceramic oxide materials.

11. The conductor roll of claim 10, wherein the ceramic oxide comprises alumina, zirconia, chromia, or a combination thereof

12. The conductor roll of claim 11, wherein the ceramic oxide further comprises titania.

13. The conductor roll of claim 11, wherein the zirconia further contains MgO, CeO_2, Y_2O_3, or a combination thereof.

14. The conductor roll of claim 9, wherein the width of the intermediate portions is greater than 10 mm.

15. The conductor roll of claim 9, further comprising a seal over the ceramic surface.

16. The conductor roll of claim 9, wherein the intermediate portion comprises a metal-containing substrate with a ceramic coating having a thickness ranging from about 0.2 mm to about 2 mm.

17. An electroplating system containing a conductor roll comprising:

a central portion with a metal-containing surface;

intermediate portions with a ceramic surface; and

end portions with a rubber surface.

18. The system of claim 17, wherein the intermediate portion comprises a metal-containing substrate with a ceramic coating.

19. The system of claim 17, further comprising a seal over the ceramic surface.

20. A method for making a conductor roll for electroplating steel sheets, comprising:

providing a central portion with a metal-containing surface;

providing intermediate portions with a ceramic surface; and

providing end portions with a rubber surface.

21. The method of claim 20, wherein the intermediate portion comprises a metal-containing substrate with a ceramic coating.

22. The method of claim 21, including providing the ceramic coating on the metal-containing substrate by spray coating a ceramic-oxide material on the substrate.

23. The method of claim 22, further including spray coating by using plasma spray-coating.

24. The method of claim 22, including spray coating for a time sufficient to form a coating with thickness ranging from about 0.2 to about 2 mm.

25. The method of claim 22, including spray coating over an area of the metal-containing substrate to form a coating with a width greater than about 10 mm.

26. The method of claim 20, further including providing a seal over the ceramic surface.

27. The method of claim 21, further including spray coating a metal coating on the metal-containing substrate before providing the ceramic coating.

28. The method of claim 27, wherein the metal of the metal coating and the metal-containing substrate are the same.

29. A method for using a conductor roll, comprising:

providing a conductor roll having a central portion with a metal-containing surface, intermediate portions with a ceramic surface, and end portions with a rubber surface;

immersing the conductor roll in a plating solution; and

rolling a stainless steel sheet over the conductor roll.

30. The method of claim 29, wherein the method electroplates a material in the plating solution on the stainless steel sheet.---

REMARKS

The claims have been amended as indicated above to conform them to U.S. practice. Applicants await an action on the merits.

If there is any fee due in connection with the filing of this Amendment, including a fee for any extension of time not accounted for above, please charge the fee to our Deposit Account No. 18-0013.

Respectfully Submitted,

By Ken Horton

KENNETH E. HORTON
Reg. No. 39,481

Date: March 22, 2002

3/pr

METHOD OF REDUCING A BAND MARK OF AN ELECTROPLATING STEEL SHEET

Technical Field

The present invention relates to a method of reducing a band mark on an electroplating steel sheet, for enhancing wear and corrosion resistances of a conductor roll, which comprises minimizing the level difference between the conductive material (metal band portion) and the non-conductive material (rubber section) of the conductor roll used during the process of electroplating zinc (Zn) or nickel (Ni) onto the steel sheet.

Background Art

In general, a conductor roll (1) is an electric apparatus for plating a steel sheet, installed in electrolytic bath, which is immersed into the plating solution (L) with Zinc (Zn) or Nickel (Ni) as an anode, and the conductor roll itself as a cathode. By continuously inducing a steel sheet (S) in this manner, the conductor roll carries out electroplating as illustrated in FIG. 1.

Here, with respect to the conductor roll (1), if the entire portion of its surface consists of a conductive material, the roll itself becomes electroplated. As such, in order to plate the steel sheet while not plating the conductor roll in itself, the conductor roll (1) which is in direct contact with the steel sheet (S) is made out of a non-conductive material at the outer sections (d) of the conductor roll (i.e., both end portions of the cylinder).

In other words, as illustrated in FIG. 2, a conductor roll (1) comprises an inner section (D) in the central portion of the cylinder, and an outer section (d) at the either end portion of said inner section (D). The inner section (D) comprises a conductive material, such as steel or a metal material, having superior acid and corrosion resistances in a strongly acidic plating solution. The outer section (d) comprises a non-conductive material such as rubber. Meanwhile, the width of the conductive metal material at the inner section (D) of the conductor roll (1) should be less than the minimal width of the steel sheet (S) to be plated (i.e., generally lesser by 100 ㎜).

On the other hand, Japanese Patent No. 10,245,695 (September 14, 1998), as a means of enhancing corrosion and wear resistances of a conductor roll, teaches a method of spray-coating

the steel band portion with a mixture of nickel-based alloy and tungsten carbide (WC). Meanwhile, Japanese Patent No. 4,346,693 (December 2, 1992) teaches a method of enhancing corrosion and wear resistances by coating the cobalt or nickel-based alloy with ceramics of relatively superior electric conductivity (to the degree of carbides).

Moreover, as for the non-conductive material used in the outer section (d), which comprises the both end portions of the conductor roll (1), ebonite (i.e., polymer materials), multilastic, sponge, polyurethane, etc. are used.

Moreover, as for the plating solution for immersing the conductor roll (1) during the electroplating process, the temperature used therein is approximately 70℃. Due to the differences in the mutual thermal expansion coefficients as between the metal band portion (3) of the inner section (D) and the rubber section (4) of the outer section (d) at the temperature of the plating solution in use, the rubber section (4) is characterized by greater expansion as compared to the metal band portion (3).

Therefore, in consideration of the thermal expansion coefficient of the metal band portion (3) of the conductor roll (1) and that of the rubber section (4), the level difference (h) of the rubber section (4) is made in such a manner to be lower than the level difference of the metal band portion (3). In this manner, the level of the metal band portion (3) of the inner section (D) and that of the rubber section (4) of the outer section (d) are maintained at a certain level at the temperature of plating solution in use (approximately 70℃).

However, if the deflector roll (2), which pulls the plating metal sheet (S) in both directions, applies tension via the conductor roll (1), the plating metal sheet presses against the rubber section (4), which in turn results in deformation of the rubber section (4). In particular, depending on the quality of the material, the thickness thereof, and the degree of tension therein, the extent to which it presses against the rubber section (4) may vary.

In other words, as shown in FIG. 2, as the load of the plating steel sheet (2) becomes directly concentrated on the ends of the metal band portion (3), it induces a curve deformation

(W), more severe than the level difference thereof (h). Consequently, a strip is formed (i.e., band mark) on the surface of the steel sheet (S) passing under the curve deformation region (W). This type of a band mark could be clearly confirmed with the naked eye and is one of the most severe defects of the plating steel sheet.

If the level difference (h) between the metal band portion (3) and the rubber section (4) is made to be smaller in order to reduce the band mark on a steel sheet (S), the load of the steel sheet becomes concentrated on the rubber section, and the frequency of occurrence of band marks is decreased. However, a gap is created between the conductive metal band portion and the plating steel sheet. Consequently, as shown in FIG. 4(a), static electricity (arc) is created therein.

Moreover, if static electricity is generated between the metal band portion and the plating steel plate, the metal band portion and the rubber section rapidly become damaged by static electricity. When this type of situation occurs, an abrasion work on the conductor roll must be immediately carried out once again.

Consequently, if the level difference (h) between the metal band portion (3) and the rubber section (4) is made to be smaller, the frequency of occurrence of band marks is reduced although there is a problem associated with the reduction of life of the conductor roll due to the premature damage to the metal band portion and the rubber section.

In this regard, in consideration of these problems caused by the aforementioned structural defects of a conductor roll, the present invention was devised with an objective of providing a means of eliminating a band mark on a steel sheet, which uses a non-conductive ceramic material, instead of a polymer material with a large thermal expansion coefficient.

In achieving the aforementioned objective, the present invention comprises ceramic coating portions of circular bands, placed respectively in a thin strip at the both edge regions of the metal band portion at the central portion of a conductor roll. As such, the present invention has the effects of suppressing the occurrence of static electricity and also reducing a band mark on an electroplating steel sheet by eliminating the level difference between the conductive

material (metal band portion) and the non-conductive material (rubber section) thereof. Furthermore, the present invention is capable of extending the life of a conductor roll by enhancing the wear and corrosion resistances thereof.

Brief Description of Drawings

FIG. 1 is a sectional structural diagram of a general electroplating conductor roll as installed.

FIG. 2 is a lateral structural diagram of a conventional conductor roll.

FIG. 3 is a structural diagram of a conductor roll for reducing a band mark according to the embodiment of the present invention.

FIGS. 4(a) and 4(b) are structural diagrams, which compare the embodiment of prior art with that of the present invention.

Disclosure of Invention

The method of reducing a band mark on an electroplating steel sheet according to the present invention is described as below with references to the attached figures.

The present invention comprises ceramic coating portions of circular bands, placed respectively in a thin strip at the both edge regions of the metal band portion (10) at the central portion of a conductor roll (1). At the outer side of said ceramic coating portion (20), there is a conventional rubber section (30). The width of a ceramic coating portion (20) is approximately more than 10 ㎜, or more preferably, lesser than the width of the electroplating steel sheet (S) by approximately 10 ㎜.

In other words, if the length of the metal band portion (10) is x ㎜, and the width of the plating steel sheet (S) is y ㎜, the ceramic coating portion (20) should be coated with a width (d') between (x+10) ㎜ at minimum and (y-10) ㎜ at maximum.

According to the aforementioned method, if there is no level difference between the conductive metal band portion (1) and the nonconductive ceramic coating portion (20) at room temperature, the level difference does not occur even at the temperature in use (approximately 70℃). Further, since the two elasticity coefficients are similar, the level difference does not occur due to the pressing by the plating steel sheet. Accordingly, in such cases, static electricity does not occur, and neither does a band mark.

Although there is a level difference at a certain height as between the ceramic coating portion (2) and the rubber section (30), the generation of static electricity is prevented at the source in such circumstances by reducing the level difference as compared to that of the prior art.

In other words, if the level difference of a ceramic coating portion (20) is made in such a way to be slightly higher or at flush with the rubber section (30), the load of the plating steel sheet (S) becomes concentrated onto the rubber section (30) having weak physical properties (i.e., lower elasticity coefficient), which results in a significant reduction of a band mark on a steel sheet. Further, by concentrating the load of the electroplating steel sheet (S) onto the rubber section, the weakness of the ceramic coating portion (20) is offset to the same extent, with the result of preventing damages to the ceramic coating portion.

If the width (d') of a ceramic coating portion (20) is less than 10 ㎜, there is a risk that a gap would form the space between the steel sheet (S) and the metal band portion (10) when the level difference (h) between the metal band portion (10) and the ceramic coating portion (20) is large. Through this type of a gap, static electricity would occur therein.

Moreover, if the gap between the ceramic coating portion (20) and the minimal width of a steel sheet is less than 10 ㎜, the seal between the rubber section (30) and the electroplating steel sheet (S) becomes incomplete, and the plating solution seeps through the gap, which in turn results in contamination of the plating steel sheet.

On the other hand, as for the coating method for the ceramic coating portion (20), the spray-coating method is used. It is preferable to carry out the coating by means of a plasma

sprayer in order to minimize such conditions as post-coating separation.

Further, as for the coating materials for the ceramic coating portion (20), it is preferable to use oxide-based ceramics with not so good electric conductivity, such as alumina (Al_2O_3), zirconia (ZrO_2), and chromia (Cr_2O_3). In particular, as compared to electric non-conductivity of oxidized ceramics sintered at the same thickness, there is an improvement in electric non-conductivity of oxidized ceramics after spray-coating.

Approximately 3-40wt% of titania (TiO_2) is added to the aforementioned coating material of a ceramic coating portion (i.e., alumina, zirconia, chromia). By adding more titania as such, the toughness of the coating material improves. As compared to pure zirconia, the zirconia used herein is a partially stabilized zirconia with a small amount of added MgO, CeO_2, Y_2O_3, etc.

As for the aforementioned material, which is in a form of powder, a comparatively fine powder should be used with a particle size of approximately 5~50 ㎛. Depending on the particle size of the powder in use, the porosity and roughness of the coating may vary, and by using fine powder, the porosity and roughness can be lowered to the maximum.

Moreover, since there are approximately 5~10% of micro-pores still remaining on the ceramic coating even after lowering the porosity, a sealing treatment is carried out with a material (e.g., urethane or epoxy), which can tolerate the acidic plating solution at the temperature in use. There, only if the plating solution does not seep through the coating layer, can it prevent contamination of a plating steel sheet, even after replacing the plating solution.

Preferably, the thickness of the ceramic coating portion (20) should be 0.2~2 ㎜. If the thickness of the ceramic coating portion (20) as coated is 0.2 ㎜ or less, it becomes easily worn out due to the deterioration of electric non-conductivity, which in turn results in inconvenience of re-coating work within a short period of time. On the other hand, if the thickness as coated is 2 ㎜ or more, it is characterized by deterioration of wear resistance with easy cracking due to the deterioration of bonding force of the coating layer.

As for the ceramic spray-coating, there is a deterioration of bonding force in the case of direct coating with the metals such as steel. Accordingly, in using the method of spray-coating, the metal coating is first carried out, followed by ceramic spray-coating. As for spray-coating the metals, it is preferable to coat it by using a plasma or high-speed sprayer.

Meanwhile, by using the same coating material as the metal material used in the metal band portion (10), the differences in the thermal expansion coefficients can be minimized, with the result of preventing separation and extending the life of the coating.

For the following reasons, it is preferable to set the thickness of the metal coating at 50~200 ㎛. If the thickness of the coating is 50 ㎛ or less, the effect of the metal-bonded coating layer becomes insignificant. If the thickness of the coating is 200 ㎛ or more, there is a decline in economical efficiency.

Best Mode for Carrying Out the Invention

In the simulator tester, hastelloy (H) was used as a material for the metal band portion (10) of a conductor roll (1), and multilastic (M) was used as a material for the rubber section (30). With respect to the ceramic coating portion (20) after spray-coating according to the present invention, the degree of formation of a band mark on a plating steel sheet was measured by using a gloss measurement device.

Meanwhile, the length of the metal band portion (10) using hastelloy was 700 ㎜, and the minimal width of a plating steel sheet (S) was 800 ㎜. As for the spray-coating on the ceramic coating portion (20), the test was carried out with its width of 25 ㎜.

As for the coating material of the ceramic coating portion (20), the material of Al_2O_3-13%TiO_2 was used. There, the powder with a particle size of 5-30 ㎛ was used to coat the ceramic coating portion (20) by means of using a plasma sprayer. The metal-bonded coating layer was coated with a hastelloy material by means of using a high-speed sprayer.

As typically shown in FIG. 4, the metal-bonded coating layer was finished off at a

thickness of approximately 100 ㎛, and the ceramic coating layer at approximately 600 ㎛. After spray-coating, a commercially sold sealing agent was sprayed thereto. Then, after the abrasion work, the testing was carried out with respect to the plating steel sheets.

In the prior art, if the multilastic material is on top of the hastelloy material during the process of using a conductor roll (1), it generates static electricity. As such, under the condition of hastelloy being on top, the level difference as between hastelloy and multilastic was set to equal 0.4 ㎜.

In the present invention, it was made without any level difference between the hastelloy and the multilastic. With the multilastic material on top of the ceramic coating, the level difference was set to 0.1 ㎜.

Table 1. Measurement of the Degree of Band Mark Formation

	Scores on the Band Marks					
Type of Plating Steel Sheet	A	B	C	D	E	F
Prior Art	4.1	4.1	3.5	4.2	3.8	4.3
Present Invention	1.0	0.9	0.8	0.4	0.1	0.2

Table 1 shows the scores on the band marks according to the respective plating steel sheets and the thickness thereof in the simulator tester. As shown in Table 1, the higher the scores on the band marks, the more severe the band marks became with exasperating differences from the normal sections.

In the present invention, it showed a significant reduction of a band mark, even to the degree of posing difficulties in identification with the naked eye. Furthermore, there were no problems associated with occurrence of static electricity during its use. While the rubber material was easily worn out during the abrasion work on a conventional roll, the problem was effectively solved by preventing such premature wearing-out by means of ceramic coating, with the effect of extending the life of a roll.

Industrial Applicability

According to the method of reducing a band mark on an electroplating steel sheet according to the present invention, it prevents generation of static electricity by minimizing the level difference between the conductive material (metal band portion) and the non-conductive material (rubber section). In this manner, the frequency of occurrence of band marks on plating steel sheets is reduced. Moreover, the present invention has the effects of enhancing wear and corrosion resistances, which in turn results in extending the life of a plating apparatus.

CLAIMS

What is claimed is:

1. A method of reducing a band mark on an electroplating steel sheet, in relation to manufacturing a conductor roll used in electroplating a steel sheet, which comprises ceramic coating portions (20) of circular bands, placed respectively in a thin strip at the both edge regions of a metal band portion (10) at the central portion of a conductor roll (1), and a rubber section (30) at the outer side of said ceramic coating portions (20).

2. The method of reducing a band mark on an electroplating steel sheet according to Claim 1, wherein said ceramic coating portions (20) are coated at 0.2~2 ㎜ by means of spray-coating, using a material of oxide ceramics, which is selected from the group consisting of zirconia, alumina, and chromia, in powder with a particle size of 5~30 ㎛.

3. The method of reducing a band mark on an electroplating steel sheet according to Claim 2, which comprises carrying out a plasma spray-coating by adding 3~40wt% of titania to alumina or chromia in order to increase the toughness of said ceramic coating portions (20), and then adding a small amount of CeO_2, Y_2O_3 or MgO to zirconia.

4. The method of reducing a band mark on an electroplating steel sheet according to Claim 1 or 2, wherein the width of said ceramic coating portion (20) is 10 ㎜ or more at minimum, in between the conductive metal band portion (10) and the non-conductive material, with the maximum width of the coating having a difference of 10 ㎜ or more than the width of a plating steel sheet.

5. The method of reducing a band mark on an electroplating steel sheet according to Claim 1, which comprises carrying out a sealing treatment, after ceramic coating, on the ceramic coating portions (20) at the both edge regions of the metal band portion (10), using a sealing agent of urethane or epoxy, followed by abrasion work.

6. The method of reducing a band mark on an electroplating steel sheet according to Claim 1, which comprises spray-coating at a thickness of 50~200 ㎛, using a metal-base material prior to coating the ceramic coating portion (20).

7. The method of reducing a band mark on an electroplating steel sheet according to Claim 6, which comprises using a plasma spray method or a high-speed spray method, using a metal-based material which is the same conductive metal material as that of the metal band portion (10).

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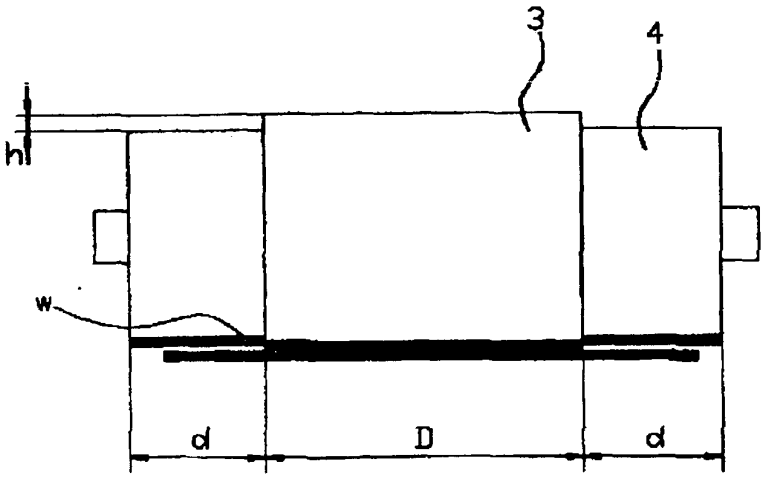
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHOD OF REDUCING A BAND MARK OF AN ELECTROPLATING STEEL SHEET



(57) Abstract: The present invention relates to a method of reducing a band mark on an electroplating steel sheet, which can also reduce plating defects and damages to the materials caused by the differences in the physical characteristics of composition materials of a conductor roll used during electroplating Zn or Ni onto a steel sheet. In other words, the present invention comprises ceramic coating portions of circular bands, placed respectively in a thin strip at the both edge regions of the metal band position at the central portion of a conductor roll. In this manner, the present invention has the effects of reducing a band mark on a plating steel sheet, and also suppressing the generation of static electricity by eliminating the level difference between the conductive material (metal band portion) and the non-conductive material (rubber section). The present invention is also cabaple of extending the life of a conductor roll by enhancing the wear and corrosion resistances thereof.

WO 02/12595 A1

FIG. 1

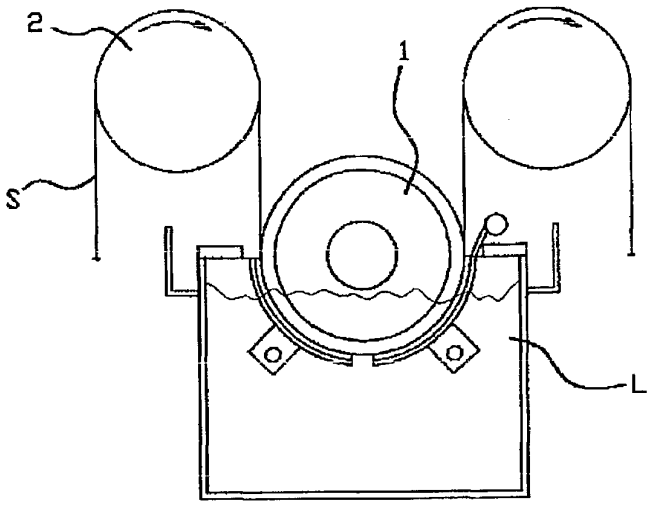


FIG. 2

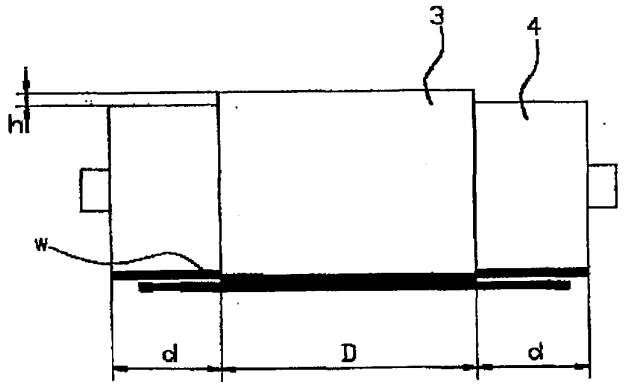


FIG. 3

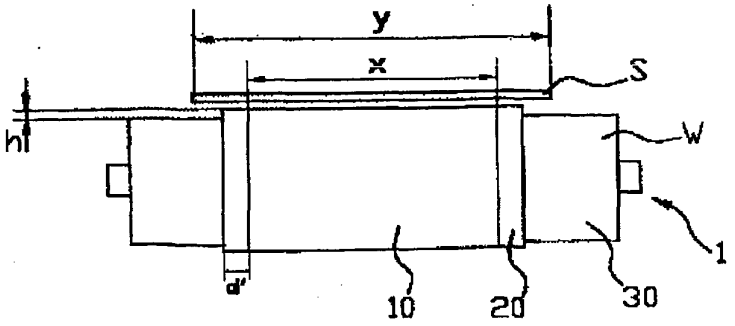


FIG. 4(a)

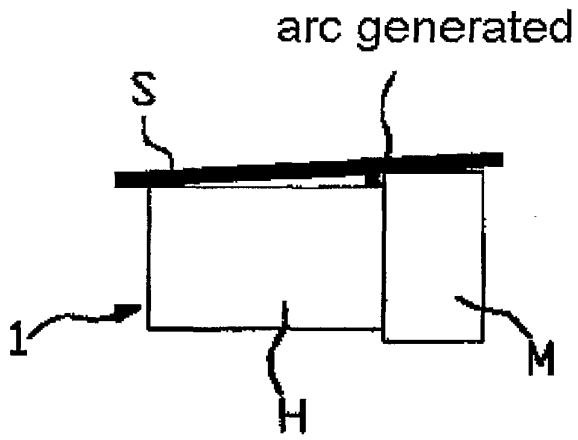
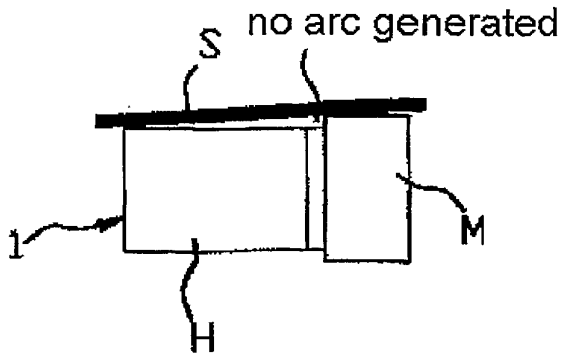


FIG. 4(b)



ATTORNEY DOCKET 40038-0001

DECLARATION FOR PATENT APPLICATION (WITH POWER OF ATTORNEY)

As an inventor named below or on any attached continuation page, I hereby declare that:

My residence, post office address and citizenship are as stated next to my name.

I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a design patent is sought on the invention entitled METHOD OF REDUCING A BAND MARK OF AN ELECTROPLATING STEEL SHEET, the specification of which (check one):

☐ is attached hereto.

☒ was filed on March 22, 2002 as United States application serial no. 10/089,125 and was amended on _____.

☐ was filed on _____ as PCT international application no. _____ and was amended under PCT Article 19 on _____.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the U.S. Patent and Trademark Office all information known to me to be material to the patentability of the subject matter claimed in this application, as "materiality" is defined in Title 37, Code of Federal Regulations § 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate or § 365(a) of any PCT international application(s) designating at least one country other than the United States of America listed below and on any attached continuation page and have also identified below and on any attached continuation page any foreign application for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America having a filing date before that of the application(s) on which priority is claimed.

Prior foreign/PCT application(s):

(number)	(country)	(day/month/year filed)	Priority Claim Yes	No
PCT/KR00/00792	Korea	July 24, 2000	X	

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) or § 365(c) of PCT international application(s) designating the United States of America listed below and on any attached continuation page and, insofar as the subject matter of each of the claims of this application is not disclosed in any such prior application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose to the U.S. Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations § 1.56 which became available between the filing date of such prior application and the national or PCT international filing date of this application:

(application serial no.)	(filing date)	(status - pending, patented or aban
(application serial no.)	(filing date)	(status - pending, patented or aban

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I hereby claim the benefit under Title 35, United States Code §119(e) of any United States provisional application(s) listed below.			
Application Number (s)	Filing Date (MM/DD/YY)	☐	Additional provisional applicatic numbers are listed on a supplement priority data sheet PTO/SB/02B attached hereto.

I hereby appoint the practitioners listed under Customer Number 27,966, as well as those listed below, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

Kenneth E. Horton, Reg. No. 39,481; Steven L. Nichols, Reg. No. 40,326; and D. Delos Larson, Reg. No. 46,118.

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(801) 572-8106

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Republic of Korea

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(application serial no.)	(filing date)	(status - pending, patented or abandoned)
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Inventor's Signature Hyung-jun Kim Date August 6th, 2002

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